Probabilistic Automated Bidding in Alternative Auctions

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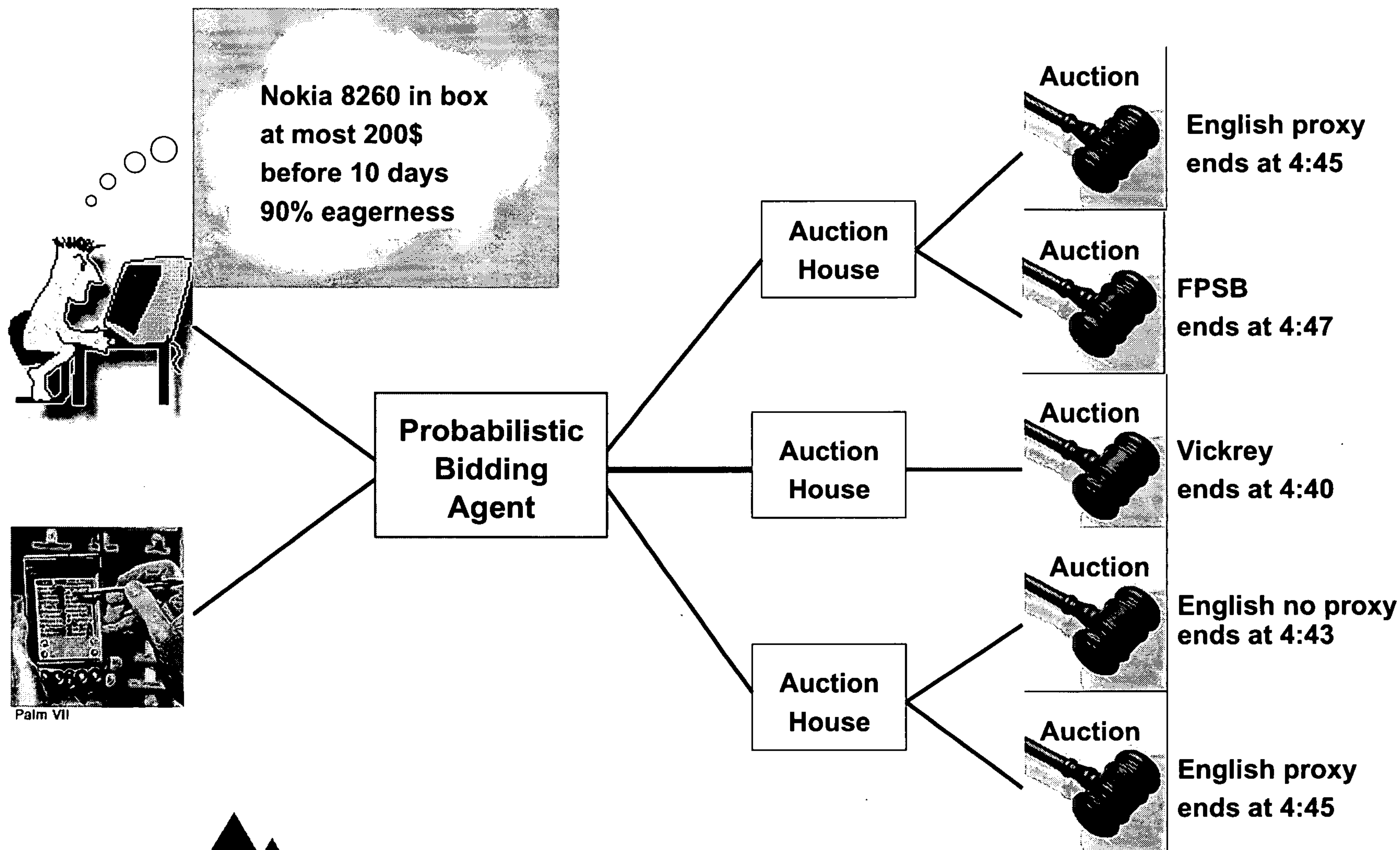
Vision



Nokia 8260 in box
at most 200$
before 10 days
90% eagerness
Palm VII
Probabilistic Bidding Agent
Auction House
Auction House
Auction House
Auction
English proxy ends at 4:45
Auction
FPSB ends at 4:47
Auction
Vickrey ends at 4:40
Auction
English no proxy ends at 4:43
Auction
English proxy ends at 4:45

Goal

To obtain one unit of an item at the lowest price, given the following parameters:

M: The maximum bidding price

D: The deadline for obtaining the item

G: The *eagerness* to obtain the item

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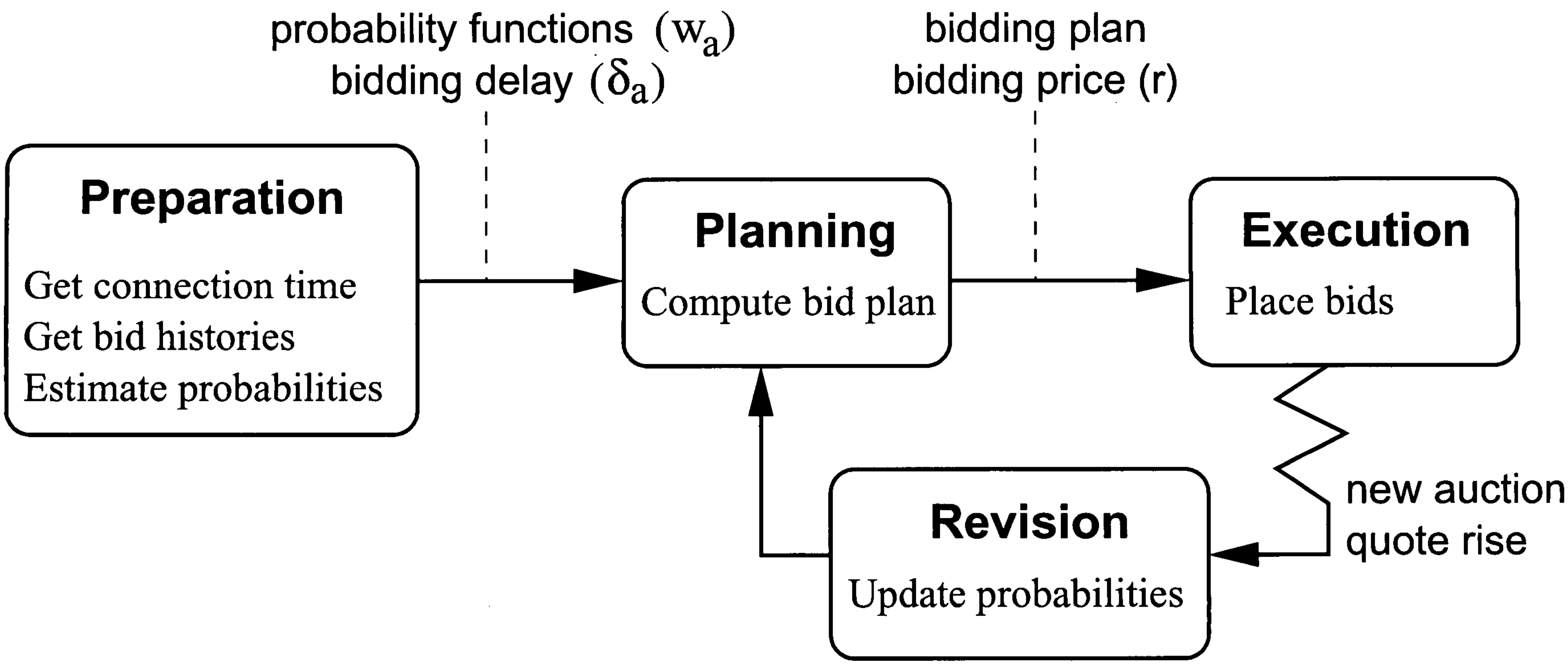
Auctions are single-unit with fixed deadlines:

- eBay-style auctions with or without proxy bids
- FPSB and Vickrey auctions

Approach

A bidding agent operates in 4 phases:



Preparation: Probability estimation

Given the history of Winning Bids (W.B.) and the quote q of an auction, the probability of winning with a bid of r can be computed in two ways.

Histogram method

$$w(r) = \frac{\text{\# of auctions with W.B. between q and r}}{\text{\# of auctions with W.B. greater than q}}$$

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Normal distribution method

$$\text{w(r)} = \frac{\int_{\frac{q-\mu}{\sigma}}^{\frac{z-\mu}{\sigma}} e^{-x^2/2} dx}{\int_{\frac{q-\mu}{\sigma}}^{\infty} e^{-x^2/2} dx}$$

μ = average W.B.
σ = std. dev. of W.B.

Planning: Problem statement

Given a set A_a of announced auctions, find:

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such that:

- Auctions in A_s are mutually compatible

$$\forall a_1, a_2 \in A_s \; |end(a_2) - end(a_1)| \geq \delta_{a1} + \delta_{a2}$$

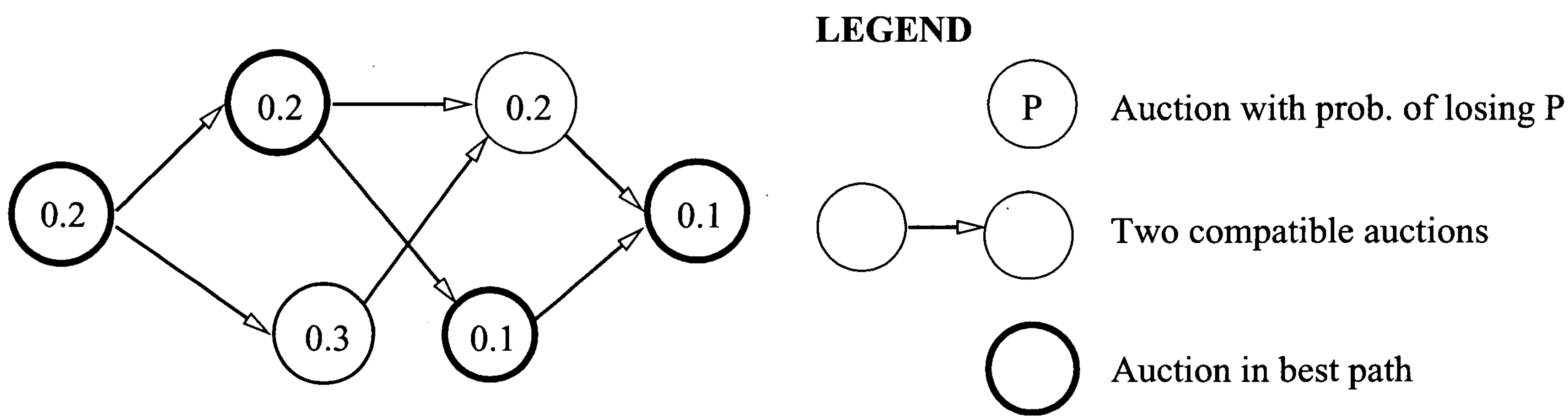
- Probability of winning 1 auction is satisfactory

$$1 - \prod_{a \in A_s} (1 - w_a(r)) \geq G$$

- *r* is minimal w.r.t. the previous constraints

Planning: Computing the best plan

For a given price *r*, it is possible to compute the best bidding plan using a *critical path algorithm*.



Prob. of loosing in best plan = $.2^2 \times .1^2 = .004$

Prob. of winning in best plan = $1 - .004 = 99.6\%$

Planning: Minimising the bidding price

For each r between 1 and M

  Compute the best bidding plan at price r ;

  If the prob. of winning with this plan is $\geq$ G, stop iterating

If no appropriate r is found, notify the user.

Otherwise, take r as the bidding price.

Note: Binary search can be used as optimisation

Plan execution

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A plan revision is triggered in the following cases:

- A new auction for the required item appears
- The quote of an auction in the plan rises above the bidding price

Heterogeneity between auctions

Alternative auctions are often heterogeneous:

- Different item characteristics
- Different settlement and shipping conditions

  Different sellers

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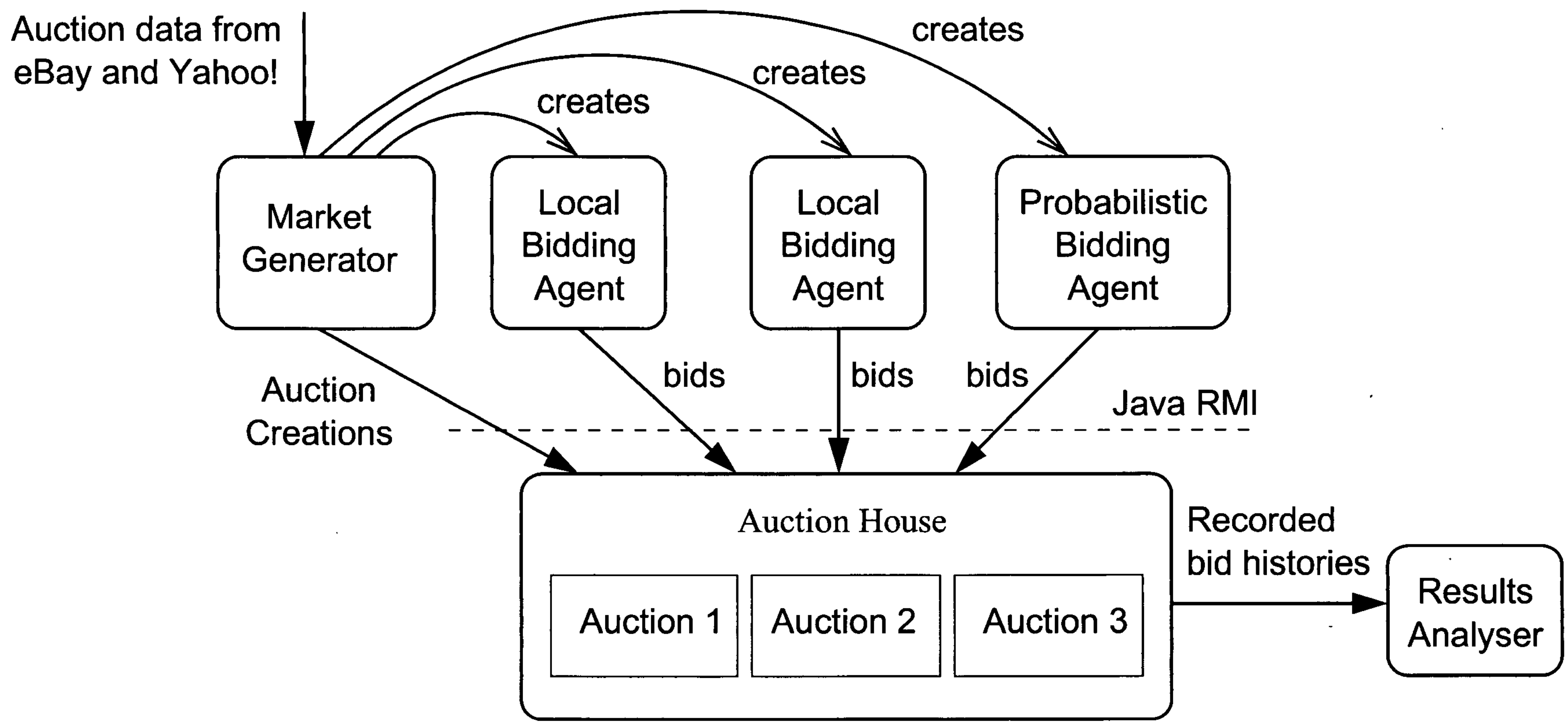
Two approaches to deal with heterogeneity:

- Price differentiation. The user sets a different maximum price for each auction
- Utility differentiation. The user provides a multi-attribute scoring system

Experimentation

Auction simulation platform



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Tested claims

1. The percentage of times that a probabilistic bidder wins is equal to its eagerness

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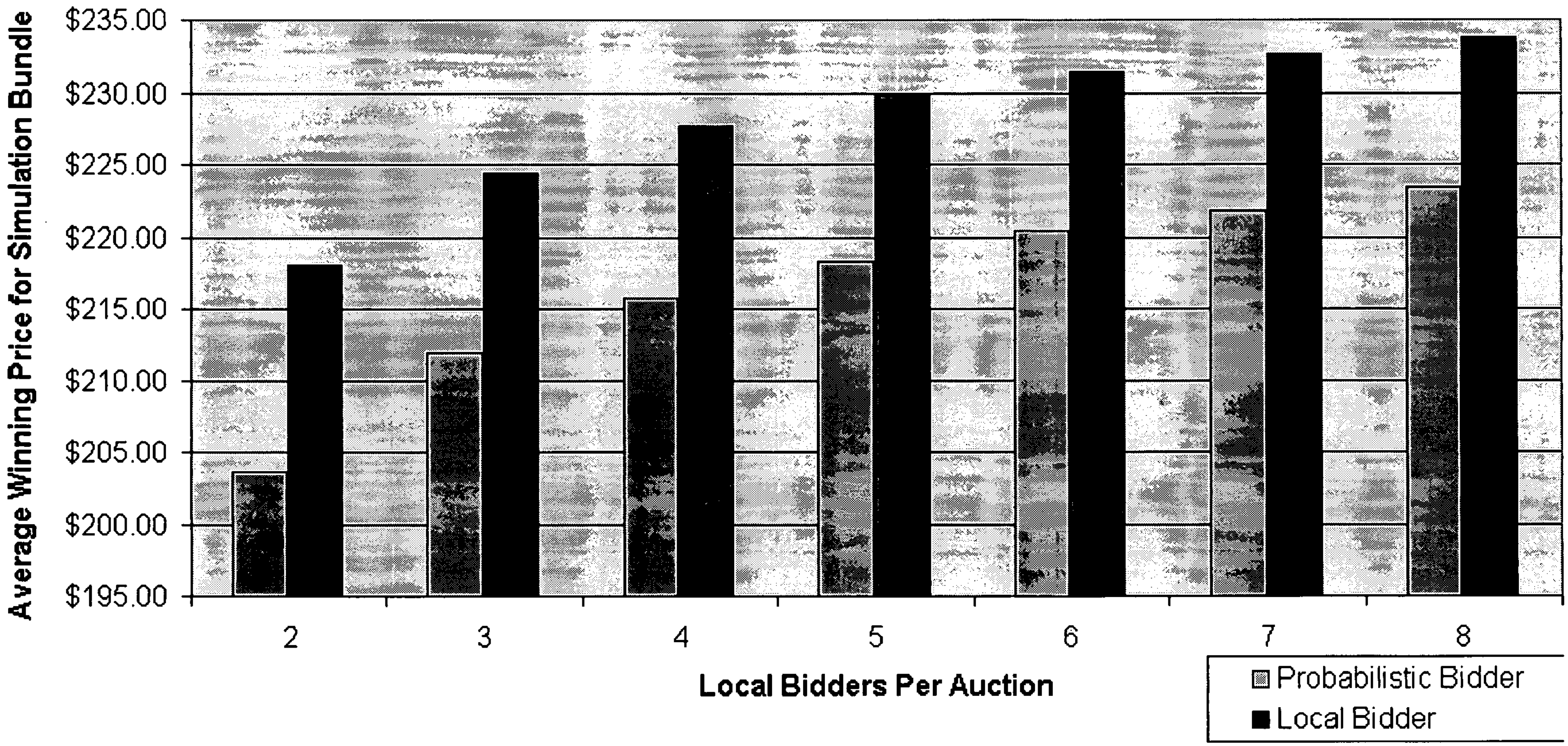
1. The percentage of times that a probabilistic bidder wins is equal to its eagerness
2. Probabilistic bidders pay less than local ones
3. The welfare of the market increases with the number of probabilistic bidders

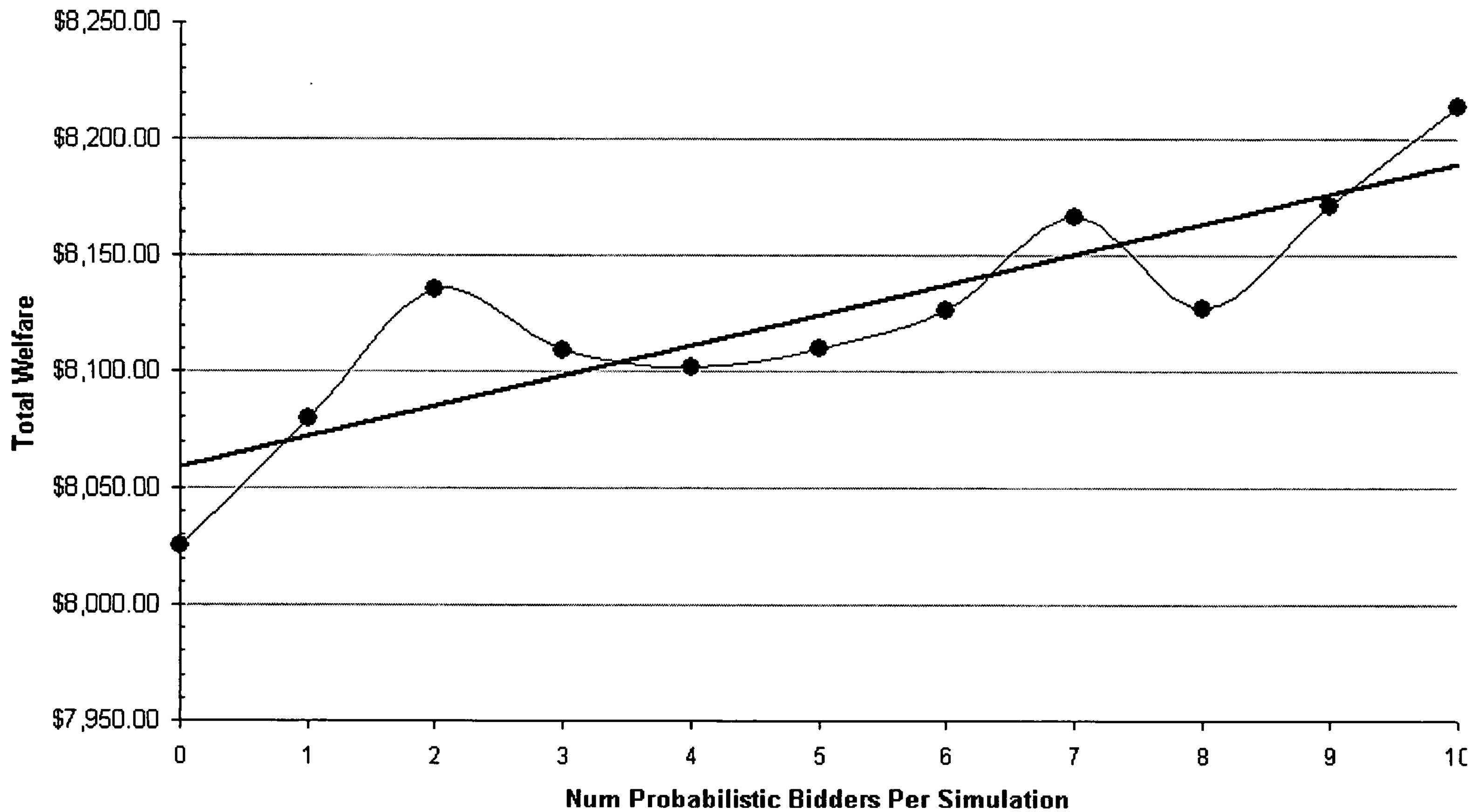
Experimentation

Validation of Claim 2



Experimentation

Validation of Claim 3



Conclusion

Probabilistic bidding agents:

- allow bidders to make tradeoffs between price and eagerness;
- increase the payoff of their users and the welfare of the market

Future extensions:

- Multiple units of an item / multi-unit auctions
- Interrelated items (all-or-none transactions)